SEEBURG HDLM 8
Operation Manual

HIGH DEFINITION LOUDSPEAKER MANAGEMENT

SEEBURG
acoustic line

The manual is related to the HDLM 8 firmware version 2.0 and hardware revision 2
2010-2013, Revision 11

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You may download this manual directly from your HDLM 8 by following URL:
http://<IP address of your HDLM 8 >/manual.pdf

Do not open the top cover of the HDLM 8. There are no user serviceable parts inside. Improper operation, handling or maintenance can result in death or severe injury.

Contents

1. Introduction

The HDLM 8 is a powerful DSP audio processing device. It offers strong tools for management and equalization of single or multi-path loudspeaker systems.

Simple Operation

All parameters can be reached in real time using the coloured high resolution display. The easy and straight handling of the device opens up in few minutes, even to the unexercised user.

Remote Control without any Software Installation

You can control the HDLM 8 without the need of installing any software to your computer. Simply use your web browser to reach the most important parameters in real time. Multiple users can control the device at the same time.

Free App for Tablet Computers and Smart Phones

For Android and iOS based devices there is a free App called *GoHDLM* available. The range of functions of this app corresponds completely to the HDLM's built-in software. Optionally, there is a WLAN Stick available which turns the HDLM 8 into a wireless access point with WPA2 encryption.

Hardware Moulded DSP

The HDLM 8 makes use of a digital signal processing unit, which is based on a FPGA device[1]. Compared with traditional DSP, it computes about 480 filters aside from 16 compressor-limiter units in $32bits/96kHz$ nearly without any delay. The signal latency between analog inputs and outputs is just 0,76 milliseconds, which is approx. 0,26 meters of sound transmission.

Highest Signal Quality – Made in Germany

The most advanced converters by Burr Brown in conjunction with a very low clock jitter ensure undistorted and transparent sound with low noise. Strong and highly symmetrical output drivers are able to drive long cables even in difficult environments.
The electronic components were assembled by an ISO certified company in Germany. The operating system is based on Linux, which is a synonym for world-wide acceptance and high stability. Internal settings are stored in a SQL data base.

1.1. Signal Path

Eight Inputs – Eight Outputs

The HDLM 8 provides eight *Input Busses* and eight *Outputs*. All signals of any physical input may be mixed together to each *Input Bus*. Each *Output* is fixed to its corresponding analog one and will get its signal by any *Input Bus* (Figure 1.1).

[1] Field Programming Gate Array; reconfigurable logic elements

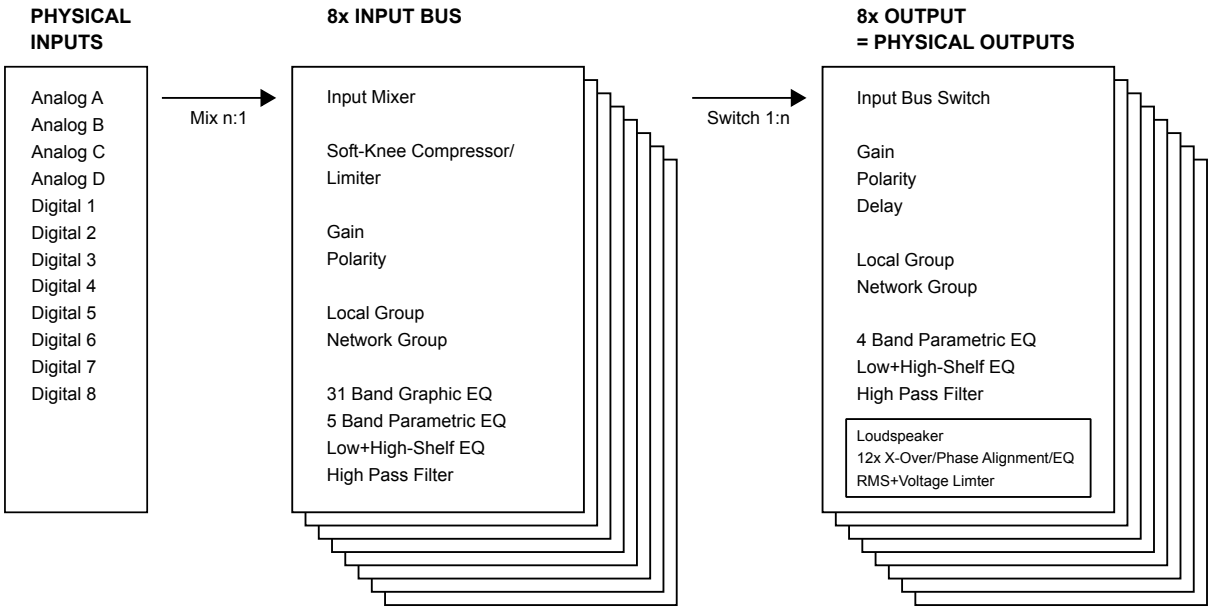


Figure 1.1.: Signal Path

Practical Options for Sound Adjustment

Besides the gain setting and a compressor-limiter unit, each *Input Bus* provides extensive filtering possibilities: Graphic EQ and Parametric EQ to equalize room acoustics, Shelving EQ for low and high correction and a high pass filter for small speaker matching. Beyond that, all busses may be linked together, both internally and network-wide in four groups.
These functions except the Graphic EQ are provided by each *Output* additionally. So you can practically spread tasks to several assistants (e.g. the band's sound engineer for Input EQ next to the PA operator for Output EQ).

Revolutionary Simple Loudspeaker Configuration

From the viewpoint of a HDLM 8 user, multi-path loudspeaker systems are treated as closed and easy-to-handle single active systems. Cross-over frequencies, equalization and power information are bundled by the manufacturer in a loudspeaker library. The library is locked and cannot be modified. If you own the *full version* of the HDLM 8, you may add additional loudspeaker systems comfortably using a proprietary description language.

1.2. Restoring after Power Failure

In the case of a power failure, all parameters will be restored automatically. The HDLM 8 saves changes after approx. five seconds to its internal memory.

2. Connections

2.1. Power Supply

The HDLM 8 has a built-in universal power supply, which will work at all voltages worldwide between 90 and 240 volt and a frequency of 50 to 60 hertz.
Thanks to the Neutrik PowerCon, the power cord is mechanically safe connected to the HDLM 8.

The PowerCon connector must not be engaged or disengaged under live. To power off the HDLM 8, one should unplug the socket of the outlet. Alternatively, one might use an outlet strip with switch.

2.2. Analog Inputs and Outputs

The inputs and outputs, utilizing Neutrik XLR receptacles, meet the standard AES14-1992. The maximum RMS voltage is $20dBu$.
The input section is built around an advanced circuit, which behaves similar to a transformer: the *common mode impedance* is sigificantly higher than in conventional electronic inputs. This comes to substantially better immunity against hum and high frequency noise, which result usually by filthy contacts, thus having a mismatched input impedance.
The output impedance of both pin 2 (hot) and pin 3 (cold) are highly balanced. Thus, interferences may be filtered out very efficiently in the next device.
Metal film resistors and high-grade operational amplifiers deliver outmost noise-free and distortion-less audio signal.
A special circuit at the analog outputs prevents loud clunk noise if the power supply is interrupted.

2.3. AES/EBU Digital Inputs

The XLR inputs C and D can be individually switched to digital-in. These comply with the AES3 standard and are transformer-isolated. The audio signal will be converted to the internal sampling frequency by an Asynchronous Sample Rate Converter, which is implemented in the FPGA. Thus, jitter will be filtered out effectively. Latency is only 48 samples. Sampling frequencies between 32 and $96kHz$ are supported. If both digital inputs are used, they must come with the same word clock, preferably from the same source.

2.4. Optional Interfaces

2.4.1. ADAT/SPDIF Optical Interface

The HDLM 8 can be expanded with an ADAT interface to eight additional inputs. After that, the HDLM 8 becomes an excellent output converter (D/A) and equalizer for digital mixing desks.

2.4.2. Gigabit AVB-Interface (Audio Video Broadcasting)

The HDLM 8 can be equipped with a 1000MBit AVB-aware ethernet interface. For further informations, please ask SEEBURG directly.

2.5. USB Interface

The built-in USB 2.0 interface is used for:

- Importing and Exporting of *Projects* and *Loudspeakers*
- WLAN Access Point Antenna[1]
- Firmware Updates

Use standard USB sticks with FAT32 file system.
The interface is protected by a self-healing $500mA$ fuse.

2.6. Ethernet Interfaces with Built-in Switch

Via the Ethernet interfaces, one or multiple computers may be connected to configure the HDLM 8. The configuration is via web interface, making special software installation unnecessary.
Use cable of category CAT-5e with RJ45 connectors.

2.6.1. Use of the Network Interfaces by Third Party Components

The HDLM 8 utilizes a fully compatible and real-time capable 10/100Mbps Ethernet Switch with two ports. This is also ideal for connecting third party networking devices, such as lighting or video equipment, or for the transmission of audio signals via DANTE or AVB. The data packets of the HDLM 8 are relatively small. The communication works stable even in heavy-loaded networks.

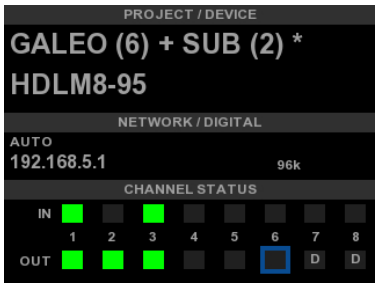
[1] available as option

3. Operation

The handling of the display menus is divided consistently in navigation using the cursor buttons and value input using the rotary encoder wheel. Additionally, there are dedicated buttons for *Mute* and EQ. See also the definition of some terms as well as an overview of keyboard operation from page 31 onwards.

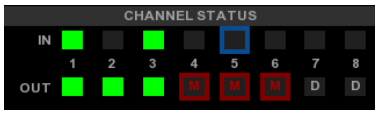
3.1. Home Page with Main Menu

After powering up the HDLM 8, the home page appears on the display. On account of large fonts this page is easy to read, even from a distance.



Home Page

On the home page, the project name, the device name, the IP address and the status of all channels is shown. Use the cursor buttons to highlight a menu item. Use ENTER to invoke the appropriate function.



Channel Status

On the *Channel Status* section, each *Input Bus* or *Output* is shown as a coloured square (Table 3.1). Use MUTE, EQ or ENTER to affect the corresponding action.

Table 3.1.: Meaning of the Status Indicators

Appearance	Indication
Gray	No Signal
Green	Signal > -40dBu
Yellow	Signal > -1dBFS
Red	Analog Overflow
Blue	*Gain Reduction*
Blue Frame	Selected
Red-Blue Frame	Selected, *Muted*
Red Frame, *M*	*Muted*
D	Delay

3.2. Navigation

Select a menu entry using the cross-shaped cursor buttons (Figure 3.1). On selection, the item will appear blue framed or backgrounded. Use ENTER to invoke the appropriate menu. To go back, use EXIT.

Permanent holding down of a button leads to key repeat, similar as a computer keyboard. Some menu entries end with three points ("..."), as an indication for another menu beyond that.

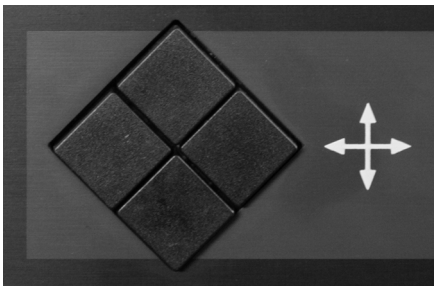


Figure 3.1.: Cursor Buttons

To return to the home page, hold down EXIT for about three seconds.

3.3. Input of Values

Variable properties are usually highlighted in green. Use the wheel (Figure 3.2) to change a value.

Figure 3.2.: Rotary Encoder

3.3.1. Increasing the Number of Steps

You may accelerate the input by a factor of ten. Hold down ENTER while turning the wheel.

3.4. Confirm Changes

For most properties, the change of a value takes place in real time. However, there are properties which would make no sense to take effect immediately. These are displayed with a yellow background instead and changes will only be valid after pressing ENTER.

3.5. Function Buttons *MUTE* and *EQ*

Press MUTE to mute or un-mute a selected *Input Bus* or *Output*. Press EQ to invoke the EQ page.

3.6. Mute All Immediately

Press [ENTER] while holding down [MUTE]. All *Outputs* will be muted immediately.

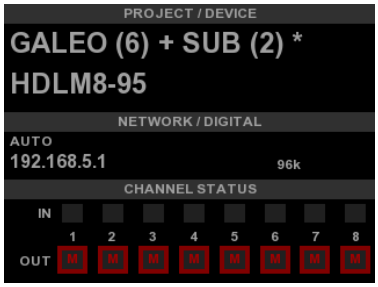


Figure 3.3.: All Outputs Muted

3.7. Key Lock

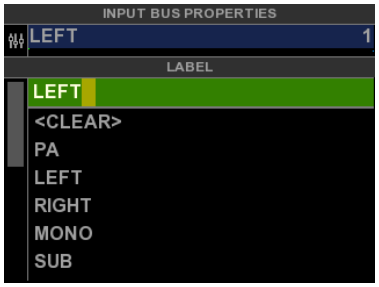
3.7.1. Lock

Press [ENTER] while holding down [EQ]. The function is available only on the home page.

3.7.2. Un-lock

Again, press [ENTER] while holding down [EQ]. The lock will be canceled.

3.8. Text Input



Text Input

Text input fields are green backgrounded having a yellow cursor. Use the horizontal cursor buttons to move the cursor left or right. Use the wheel to change the character at the cursor. To get a space character, just move to the most right.
Usually, changes will take effect immediately, so there is no need to confirm.

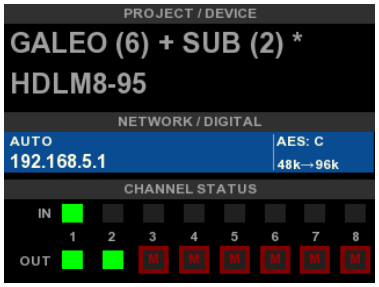
3.8.1. Delete Characters

Hold down [ENTER] while turning the wheel. According to the rotation, characters before or after the cursor will be deleted.

3.8.2. Predefined Keywords

Where appropriate, the HDLM 8 offers a small list of predefined keywords below a text input field. Use the list to assemble a complete label in seconds without the need of wheeling in character by character.

3.9. Digital Input States



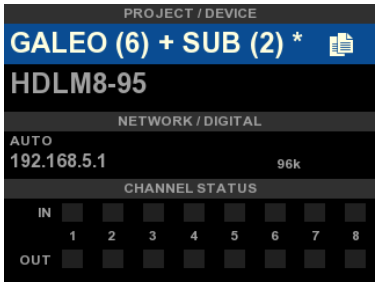
Digital Input States

The state of the incoming digital signal will be shown in the right column of the network/digital menu item. See page 18 *Digital Interfaces*.

3.10. Fast Navigation for the Advanced User

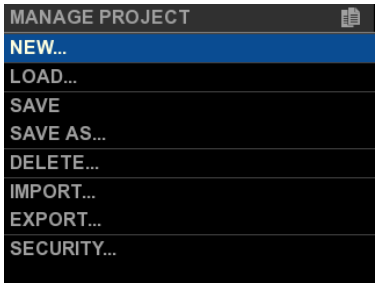
Combine the cursor buttons with the wheel to move on faster. Hold down a button while turning the wheel. The selection follows according to the direction of rotation.

3.11. Project Management



Name of Project

To invoke the project menu, move the selection to the first entry of the home page and confirm with ENTER.
The asterisk in the right indicates that changes have been made and disappears after saving again.

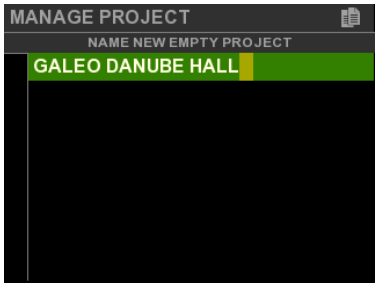


Project Menu

Select a menu entry using the cursor buttons and confirm with ENTER.

In the following, the individual properties of the Project Menu are described.

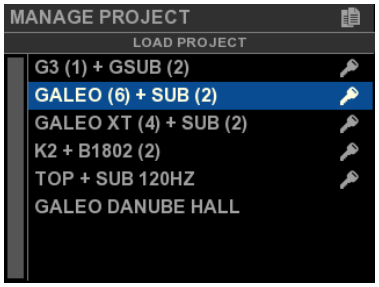
3.11.1. New Project



Input of Project Name

A new project requires necessarily a label. Using the wheel, enter the name character by character and confirm with ENTER.
After creating a new project, all *Outputs* will be muted and set to *Direct Out*. All EQs will be set to flat.

3.11.2. Loading

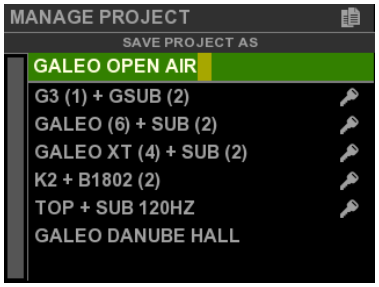


Load a Project

Select a project from the list. Confirm with ENTER.
The list is sorted alphabetically and by number of loading: often used projects are shown first.

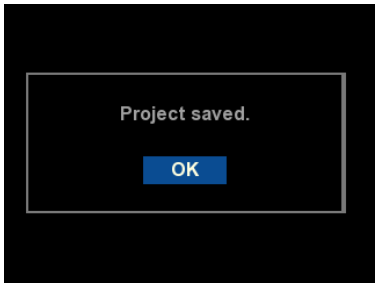
Dependent of the setting *Mute On Project Load*, all *Outputs* will mute (see page 17). You have to un-mute them manually.

3.11.3. Saving



Overwrite a Project

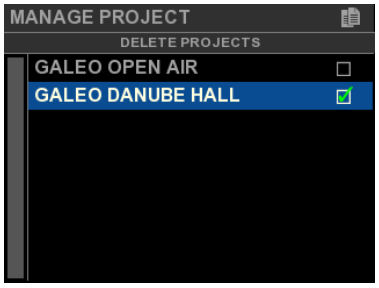
Enter a new name using the wheel or select a project from the list you want to overwrite. Confirm with ENTER.



Save a Project

The action will be confirmed with a message.

3.11.4. Deleting



Delete Projects

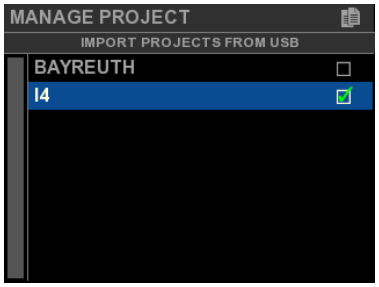
Select one or more projects using the cursor buttons and the wheel. Confirm with ENTER. All projects tagged with a green check will be deleted.

Hint: the current loaded project cannot be deleted.

3.11.5. Project Import from USB

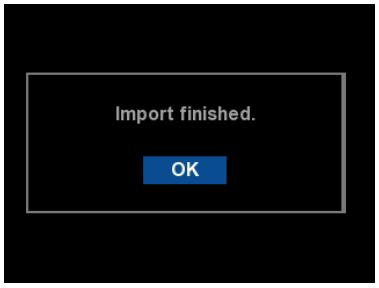
Show Files of USB stick

Plug in an USB stick into the HDLM 8 and confirm the message *USB device inserted?*. The USB device will be searched on its top level for files having the *.hdlm8* extension.



Import Projects

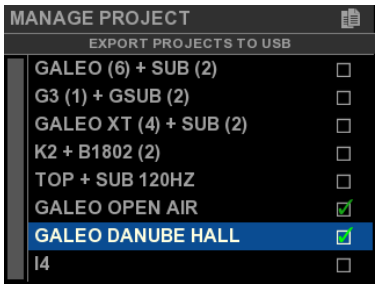
Use the cursor buttons to select and choose one or more projects using the wheel. After confirmation with ENTER, the tagged files will be imported and stored permanently on the HDLM 8.
If there are new *Loudspeakers* used by the importing project files, they will also be loaded into the *Loudspeaker Library*.



Import Completed

Do not remove the USB stick before you have confirmed this message with ENTER.

3.11.6. Project Export to USB

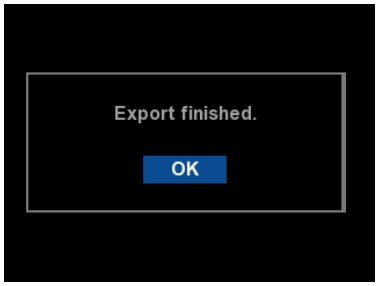


Export Projects

Use the cursor buttons to select and choose one or more projects using the wheel. After confirmation with ENTER, the tagged projects will be stored to the USB device.

Export

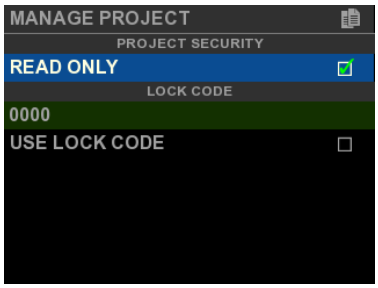
Wait for the operation to be completed.
Additionally, the exported file contains all *Loudspeakers* used in the corresponding project, so you may import this file on any HDLM 8 without trouble.



Export Completed

Do not remove the USB stick before you have confirmed this message with ENTER.

3.11.7. Write Protection



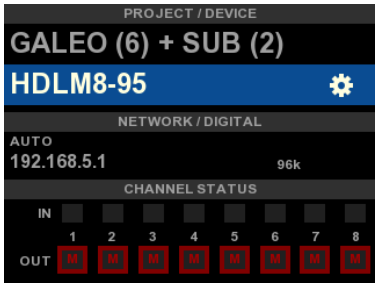
Protect Projects

Use the *Security* menu to protect projects from overwriting accidentally. There are two modes: a simple *Read Only* flag and protection using a lock code (four digits).

The write protection will not take effect before saving the project!

3.12. Device Settings

The properties of the Device Settings menu are stored independently from the current project. Changes will be saved internally within five seconds.



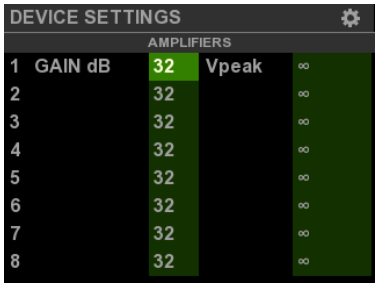
Invoke the Device Settings Menu

To invoke the Device Settings menu, select the second item on the home page and confirm with ENTER.

In the following, the individual properties of the Device Settings menu are described.

3.12.1. Amplifiers

These are important parameters to the automatic calculation of the output limiters. Set the appropriate gain of the connected amplifier to each channel.



Amplifiers

The eight rows correspond to the eight physical outputs. Optionally, you may specify the peak output voltage V_{peak} of the amplifier. The HDLM 8 will ensure that the output signal will never exceed this limit, even if there are larger values in the loudspeaker settings. By that, amplifiers without or with insufficient limiters may be used safely. Enter this value only if you know that your amplifiers do not have clean working limiters.

Hint: the V_{peak} limiter provides additional security, but always at the expense of dynamics[1].

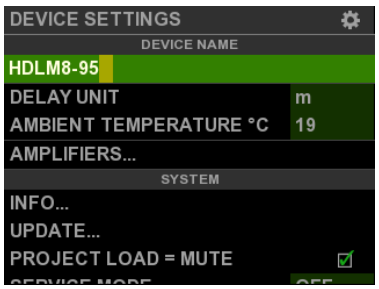
It is important that the amplifiers connected deliver exactly the same gain set as in the Amplifiers Menu. Adjust the volume control on the amplifiers always to $0dB$ (usually turned up full).
With incorrect settings, the speakers are not protected by the limiter! See the manual for your amplifiers to find out the actual gain.

3.12.2. Delay Unit, Temperature

Set the average ambient temperature. This will be used to calculate the delay for given distance in the *Output Properties*. Altitude and air pressure information were omitted, as they have only a very small influence on the speed of sound in contrast to the temperature.
The unit for the delay can be selected between meters and feet. Depending on the unit, the temperature is specified in degrees Celsius or Fahrenheit.

[1] The corresponding RMS limiter has a crest factor of $12dB$.

3.12.3. Device Name



Device Name

Wheel-in a name for the device. This will be used to recognize the unit on the network and on the home page display. Changes will take effect immediately.

3.12.4. Info

The info page shows among other things the version of the firmware.

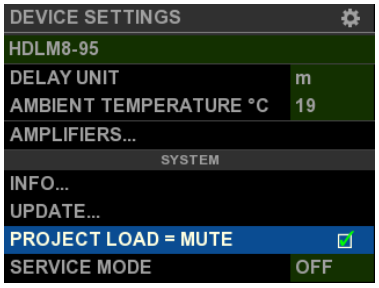
3.12.5. Update

Firmware Update

If you received an update file from the manufacturer, you may load this from the USB stick at this point. The top level of the USB device will be searched for the newest version.
All outputs will mute. This process takes about five minutes. After completion, the HDLM 8 will reboot and reactivate its outputs.

Do not interrupt the ongoing update process!
Provide a stable power supply!
An interruption may cause that the device no longer works. This can only be restored by the manufacturer or an authorized service center.

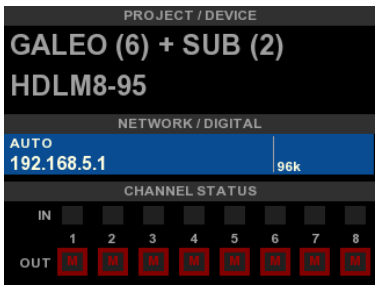
3.12.6. Mute On Project Load



Mute On Project Load

If this function is activated (default on new machines), any *Output* will be muted after loading a new project. Otherwise, the last saved mute state will be restored.

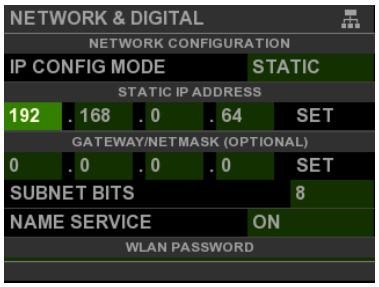
3.13. Network and Digital Interfaces Menu



Invoke the Network Menu

To invoke the Network Menu, select the third item on the home page and confirm with ENTER.

> The HDLM 8 offers automatic addressing. You need the manual (*static*) addressing mode only in some special cases.

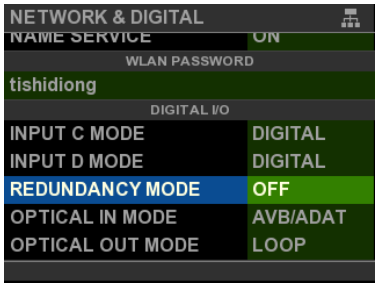


Network Menu

If manual IP addressing is desired, set *IP Config Mode* to *Static* and enter the IP address below. Each device needs an individual IP address (see page 29).
Changes will take effect after confirmation with *Set*.

The settings *Gateway* and *Netmask* are not necessary for normal operation[2].

3.13.1. Digital Interfaces



Digital Interfaces Menu

Any available digital input/output may be set up in this menu.

In the following, the corresponding functions will be described.

3.13.2. Input C Mode / Input D Mode

Switch here the XLR inputs *C* and/or *D* between analog mono or stereo digital AES/EBU. About signal routing, see page 21 *Physical Inputs*.

[2]Network experts will use these parameters to control the HDLM 8 over the Internet.

3.13.3. Redundancy Mode (Fallback)

Analog inputs will be ignored, if a valid digital signal is present. In the case of losing the digital signal, the HDLM 8 will switch back to the analog signal immediately without interruption.

Prerequisites

Assign at least one analog and one digital physical input to an *Input Bus*. In Fallback-Mode (if digital is lost), the HDLM 8 will show *Digital?* on the home screen (Figure 3.4).

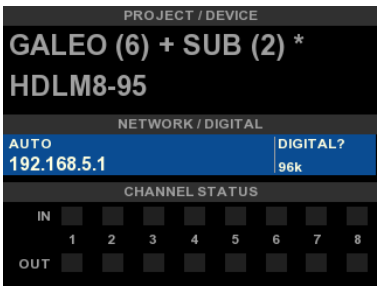


Figure 3.4.: Fallback in Redundancy Mode

3.13.4. Optical Input (optional)

Use the wheel to tell the HDLM 8 which digital input format is used. ADAT will take eight tracks, but is fixed to 48kHz sample rate. SPDIF will take two tracks and may be feed with a sample rate between 32kHz and 96kHz.

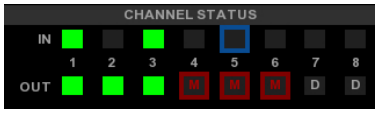
> The physical AES/EBU interface *C* cannot be used at the same time, if the optical input is set to *SPDIF* or if a valid ADAT-Signal is present.

The incoming digital signal will always be up-sampled by the internal low-latency Sample Rate Converter to 96kHz.

3.13.5. Optical Output (optional)

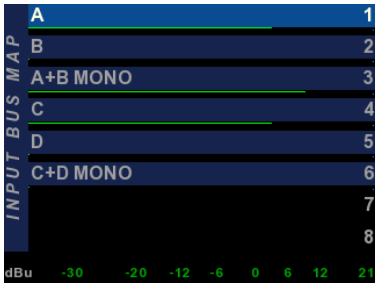
Set this function to *Loop* for using the optical output as a latency-free loop-trough of the AES/EBU input or the optical input (SPDIF or ADAT). Additionally, assign any pair of the *Output Map* to send the HDLM 8 outputs as a digital 24bit/96kHz SPDIF signal.

3.14. Input Bus Map



Channel Status

Select a channel of the first row in the *Channel Status* section on the home page and confirm with ENTER.



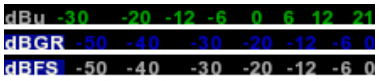
Input Bus Map

The screen changes to the *Input Bus Map*. The selected channel is highlighted.
Below each row, a green line is shown, which indicates the level meter of the bus. Activity of the compressors are indicated with blue lines coming from the right. Channels without any input assigned will appear black, without the blue background.
At the bottom of the screen, there is a dB scale with selectable units.

Input Bus Map with Mute

Use the cursor buttons to select a channel. Press MUTE to turn a channel on or off. To invoke the EQ page, press EQ. Use ENTER to invoke the *Input Bus Properties* menu of the corresponding channel.

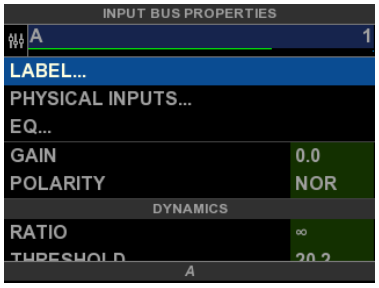
3.14.1. dB Scales



Miscellaneous dB Scales

Use the cursor down button to move the selection to the dB scale at the bottom of the screen. Use the wheel to change the unit (see page 32).

3.15. Input Bus Properties

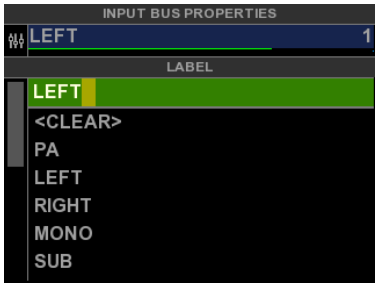


Input Bus Properties Menu

Choose a menu item.

In the following, the individual items of the *Input Bus Properties* menu are described.

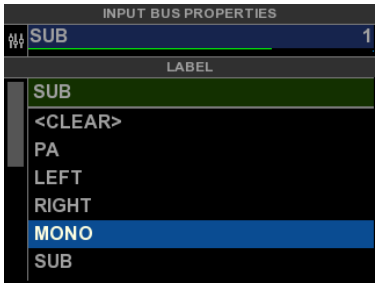
3.15.1. Label



Input Bus Label

Wheel-in a label for the channel. Changes will take effect immediately.

For rapid naming, some common predefined keywords are suggested. Use the list to assemble a complete label in seconds.



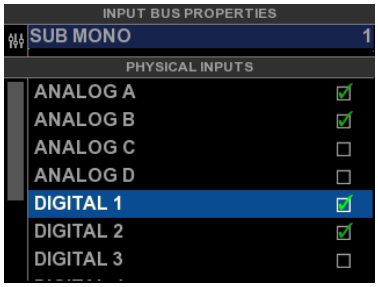
Input Bus Label Keywords

Choose a keyword and confirm with ENTER.

Input Bus Label Keywords

The keyword will be appended. A space is created automatically.

3.15.2. Physical Inputs



Physical Inputs

Select the physical inputs to mix on this *Input Bus* using the cursor buttons and the wheel. Changes take effect immediately.
Please note that depending on the configuration of the HDLM 8, not all physical inputs are available. Not available physical inputs will be displayed gray.

Hint: the mix for the physical input channels is always 1:1, without any correction. Same signals will yield a $6dB$ higher level.

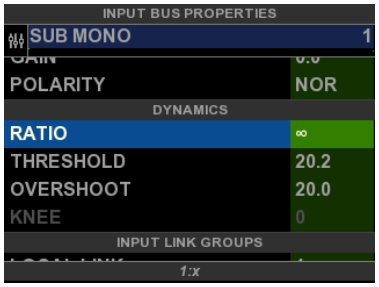
3.15.3. Gain

Set the gain for this channel. Changes take effect immediately. Please note the × 10 mode, as described on page 10.

3.15.4. Polarity

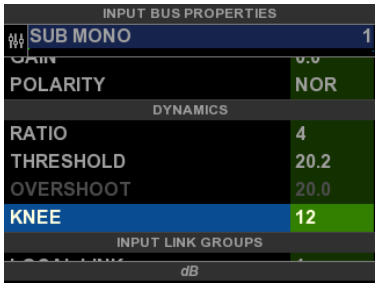
Set the signal polarity for this channel. *REV* indicates change in polarity. Changes take effect immediately.

3.15.5. Dynamics



Limiter

Set the compressor (or limiter at ratio=∞) using the *Ratio* and *Threshold* parameters. The unit of the threshold corresponds to the unit of the dB scale, if applicable. To deactivate any compression, set *Threshold* to its maximum value or set *Ratio* to 1.
Control the overflow of RMS to peak using *Overshoot* in dB. This may be targeted to determine the *Crest Factor*.



Compressor with Knee

To get a smooth compression response, use the *Knee* value. The soft knee property provides a soft increase of the ratio for *n dB* around the *Threshold* value. This is not available if the *Ratio* is set to ∞.

Hint: User adjustable dynamics are provided in the Input Busses only. The output limiters will always be set automatically to prevent misuse or incorrect operation.

3.15.6. Local Link

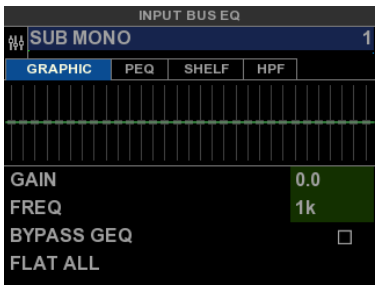
With *Local Link*, you may group all parameters of the Input Busses except *Mute*. Use the wheel to set one of four link groups and confirm with ENTER. If another Input Bus is assigned to the same group, then all parameters will be copied to this channel. All future changes lead to change the channels assigned to the same group.
For example, to achieve a stereo linking for Input Bus 1 and 2, set both channels to the same link group.

3.15.7. Network Link

With *Network Link*, you may group all parameters of the Input Busses across multiple devices on the connected network. The operation is the same as *Local Link*. Any number of HDLM 8 may be linked together, provided they are in the same network[3].

[3]To network experts: data is sent via unidirectional UDP broadcast.

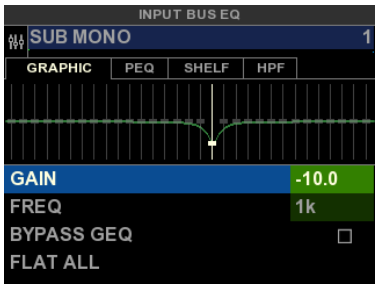
3.16. Input Bus EQ



Input Bus EQ

Invoke the Input Bus EQ using [EQ]. Make sure that an *Input Bus* was selected previously.
The green curve shows the resulting frequency response of all EQs in this channel, independent of the shown handles.
There are four tabs on the top for the sub pages *Graphic EQ*, *Parametric EQ*, *Shelving EQ* and *High Pass Filter*. Use the left and right cursor buttons to activate the appropriate page. Use the cursor down button to reach the functional section.

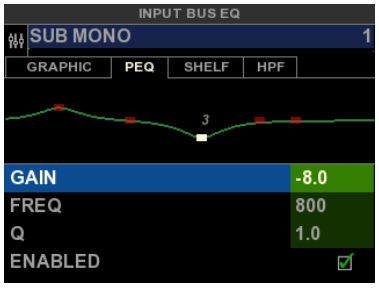
3.16.1. Graphic EQ



Graphic EQ

Choose the frequency using the horizontal cursor buttons and set the gain with the wheel. (Re-)activate an EQ with *Bypass*. Use *Flat All* to reset all gain settings.
The behaviour is the same like a classical analog *Constant Q* equalizer. The Q factor is $4,32$.

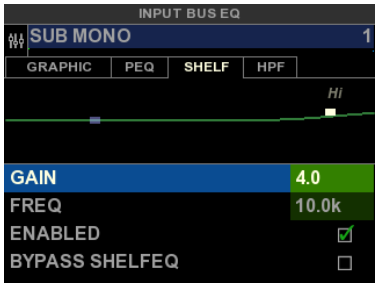
3.16.2. Parametric EQ (PEQ)



Parametric EQ

Choose one of five EQ handles using the horizontal cursor buttons. Depending on the selected menu item, set the gain, frequency or quality Q using the wheel. (Re-)activate all parametric EQs using *Bypass PEQ*. Switch single EQs on or off with *Enabled*. *Flat All* leads to reset all parametric EQs to zero gain.

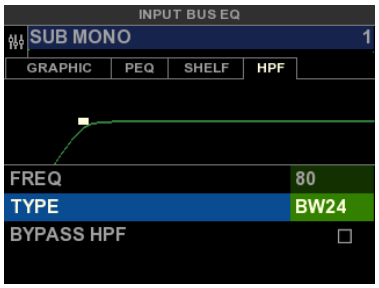
3.16.3. Shelving EQ



Shelving EQ

Use the horizontal cursor buttons to select the low shelf or the high shelf EQ. Depending on the selected menu item, set the gain or frequency using the wheel. (Re-)activate an EQ with *Bypass*. Use *Flat All* to reset all gain settings.
The handle shows the frequency position, at which $\frac{Gain}{2}$ is achieved.

3.16.4. High Pass Filter (HPF)



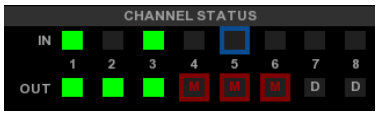
High Pass Filter

Set the frequency and select a type (Table 3.2). Switch the filter on or off with *Bypass HPF*.
The handle shows the $-3dB$ position.

Table 3.2.: Filter Types in the High Pass Filter

Label	Description
BW12	Butterworth $12dB/oct.$
LR12	Linkwitz-Riley $12dB/oct.$
BW24	Butterworth $24dB/oct.$
LR24	Linkwitz-Riley $24dB/oct.$

3.17. Output Map

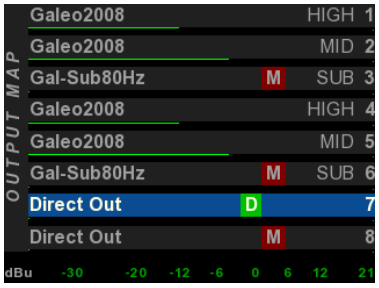


Channel Status

Select a channel of the lower row in the *Channel Status* section on the home page and confirm with [ENTER].

Output Map

The screen changes to the *Output Map*. The selected channel is highlighted.
Below each row, a green line is shown, which indicates the level meter of the physical output channel. Activity of the limiters are indicated with blue lines coming from the right. Channels, which are part of a *Loudspeaker*, will always be selected together. Parameters can be changed only on a complete loudspeaker system.
At the bottom of the screen, there is a dB scale with selectable units.



Output Map with Delay

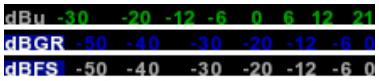
Use the cursor buttons to select a channel. Use the *Mute* button to switch a complete *Loudspeaker* on or off (a red *M* symbol will appear on mute). To invoke the EQ page, press [EQ]. Use [ENTER] to invoke the *Output Properties* menu of the corresponding loudspeaker.
If assigned, alternately the loudspeaker's name and the label is shown.
If there was set any delay, a green *D* symbol will appear.
In the right column, the number of the physical output is shown and at its left, if any, the speaker path (Table 3.3).

Unconfigured channels are shown and handled as *Direct Out*, which means that there will be the full-range signal on that output. Make sure that it does not reach a speaker which could be damaged!

Table 3.3.: Specified key words for types (paths) of speakers

Key Word	Path
empty	Self-powered Loudspeaker or miscellaneous device (*full-range*)
HIGH	Tweeter
MID	Mid-range speaker
LOW	Low-mid-range speaker
SUB	Subwoofer

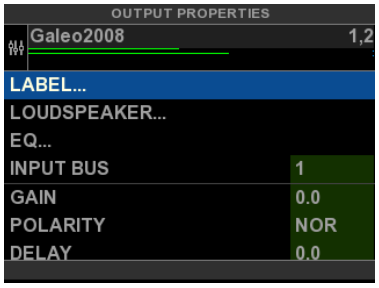
3.17.1. dB Scales



Miscellaneous dB Scales

Use the cursor down button to move the selection to the dB scale at the bottom of the screen. Use the wheel to change the unit (see page 32).

3.18. Output Properties

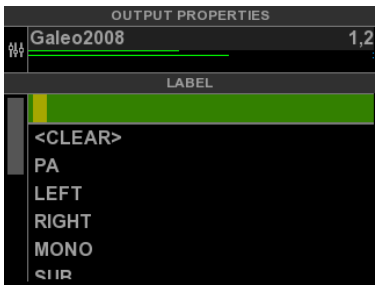


Output Bus Properties Menu

At the top of the page, you see all relevant signal level metering to the according *Loudspeaker* and its physical outputs.
Choose a menu item.

In the following, the individual items of the *Output Properties* menu are described.

3.18.1. Label

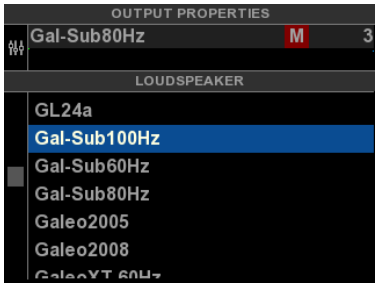


Output Label

Wheel-in a label for the loudspeaker. Changes will take effect immediately.

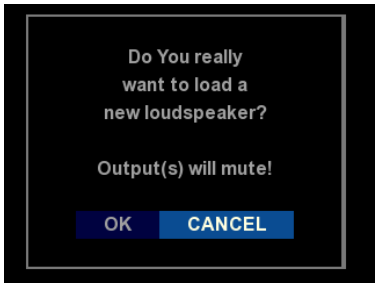
See page 21 for further features on this page.

3.18.2. Loudspeaker



Loudspeaker Library

Choose a loudspeaker from the list for loading it to the current channel.



Loading a Loudspeaker

Confirm the message. The loudspeaker will be loaded and muted. In case of need for more channels for the loaded loudspeaker, one ore more of the following channels may be freed from the *Output Map*.

The order of the single speakers is defined from high to low. You can only set the start channel of the first (highest) speaker of the loudspeaker.

Check each time you configure a new loudspeaker the *Output Map* and make sure that each speaker is connected to the correct output channel.

3.18.3. Input Bus

Select the *Input Bus* number which shall feed its signal to this channel (respectively *Loudspeaker*). Confirm with ENTER.

3.18.4. Gain

Set the gain for this channel. Changes take effect immediately. Please note the × 10 mode, as described on page 10.

3.18.5. Polarity

Set the signal polarity for this channel. *REV* indicates change in polarity. Changes take effect immediately.

3.18.6. Delay

Set the delay as a distance in meter or feet. The temperature and unit as set in the Device Settings menu will take account. If set, a green *D* symbol will appear in the corresponding row of the *Output Map*. Changes take effect immediately.
To deactivate the delay, set the value to zero.

Since changes take effect immediately, there may appear noise or interruption on the outputs while re-adjusting the distance.

3.18.7. Local Link

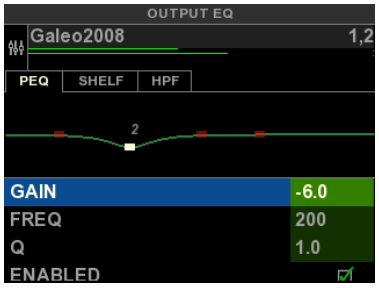
With *Local Link*, you may group all parameters of the Outputs except *Mute*. Use the wheel to set one of four link groups and confirm with [ENTER]. If another Output is assigned to the same group, then all parameters will be copied to this channel. All future changes lead to change the channels assigned to the same group.
Note, that the linking functions in the Output Map are independent from those ones in the Input Bus Map.

3.18.8. Network Link

With *Network Link*, you may group all parameters of the Outputs across multiple devices on the connected network. The operation is the same as *Local Link*. Any number of HDLM 8 may be linked together, provided they are in the same network.

3.19. Output EQ

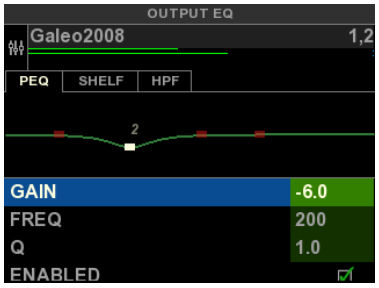
Note that all EQ settings will always take effect to the whole *Loudspeaker*. This ensures that all paths are equally modified in-phase. The drawn resulting frequency curve shows all EQ settings made in the Output EQ. Settings made in the *Loudspeaker* setup, including cross-over frequencies, are not shown here.



Output EQ

Invoke the Output EQ using the [EQ] button. Make sure that an *Output* was selected previously.
The green curve shows the resulting frequency response of all EQs in this channel, independent of the shown handles.
There are three tabs on the top for the sub pages *Parametric EQ*, *Shelving EQ* and *High Pass Filter*. Use the left and right cursor buttons to activate the appropriate page. Use the cursor down button to reach the functional section.

3.19.1. Parametric EQ (PEQ)



Parametric EQ

Choose one of four EQ handles using the horizontal cursor buttons. Depending on the selected menu item, set the gain, frequency or quality *Q* using the wheel. (Re-)activate all parametric EQs using *Bypass PEQ*. Switch single EQs on or off with *Enabled*. *Flat All* leads to reset all parametric EQs to zero gain.

3.19.2. Shelving EQ

Shelving EQ

Use the horizontal cursor buttons to select the low shelf or the high shelf EQ. Depending on the selected menu item, set the gain or frequency using the wheel. (Re-)activate an EQ with *Bypass*. Use *Flat All* to reset all gain settings.
The handle shows the frequency position at which half the gain is achieved.

3.19.3. High Pass Filter (HPF)

High Pass Filter

Set the frequency and select a type (Table 3.2). Switch the filter on or off with *Bypass HPF*.
The handle shows the $-3dB$ position.

See the description of the filter types used in the HPF in Table 3.2 on Page 24.

4. Network Setup

4.1. Operation via Web Browser

Data communication between a Personal Computer and the HDLM 8 is based on TCP/IP Ethernet technology. Thanks to that, you don't have to install any additional software on your computer. It is operated using the Mozilla Firefox browser software[1] on Windows or the Safari browser on Apple systems. Microsoft Internet Explorer is not supported.
To connect to the HDLM 8, open the web browser application and enter the IP address shown in the display. After about ten seconds, the user interface is ready and the device can now be controlled in real time.
The system is platform independent and can be used by nearly any operating system, such as Windows, Mac or Linux. However, it is necessary that the computer has a processor at 2 GHz clock frequency or higher. Up to ten computers can simultaneously access a HDLM 8.

4.2. App *GoHDLM*

The App *GoHDLM* is available for free in the corresponding app stores and runs on Apple iPhone and iPad, as well as on most Android-based smart phones and tablet computers. The range of functions of this app corresponds completely to the HDLM's built-in software.

4.3. Automatic Network Configuration

By default, the HDLM 8 offers full automatic configuration. The device will search a DHCP server in the network. If available, it will use the server's information for IP addressing. If not, the HDLM 8 will start its own DHCP server and offers this service to the network[2].

4.4. Wireless LAN Access Point

The optionally available WLAN antenna for the USB port turns the HDLM 8 into a *Wireless Access Point*. The user must set a password in the network menu. The data transmission is secured by WPA2. To ensure network security, set the password length to at least ten characters. Each HDLM 8 will be shipped with a random password. If the password is deleted by the user, it will propose a new random one.

4.4.1. Wireless LAN Configuration

All network settings apply also to the wireless LAN. Hint for experts: the WLAN and the Ethernet ports are technically bridged. The bridge acts as a layer-2-switch.

4.5. Introduction in Manual IP Addressing

The HDLM 8 offers automatic addressing. You need the manual (*static*) addressing mode only in some special cases.

[1] Get Mozilla Firefox free of charge on *http://www.mozilla.org/firefox*
[2] It will be tried to give always the same addresses to the same devices after a power cycle

To connect a Personal Computer to the HDLM 8 successfully via static addressing, you should know how IP addresses are represented and what they mean.
Whilst in ordinary networks at home or in office, there is often special equipment such as a router which will assign IP addresses. This automatic procedure is sometimes not useful for operation in the environment of loudspeaker management systems. In order to address devices directly, one needs the manual control over the network.

4.5.1. Purpose

Similar to a postal address on an envelope, data packets are provided with an identifier, which is the IP address. Thus a receiver can be clearly identified. It is therefore important that in a closed network a specific IP address occur only once.

4.5.2. Representation

IP addresses are represented in four single numbers, divided by a dot. Each part is called an *octet*. The numbers may be in the range from 0 to 255.
There is a breakdown in public and private address spaces. In the HDLM 8 environment, you will usually make use of the private address space. Following ranges may be used:

Table 4.1.: Private IP Address Space

Start	End
192.168.0.1	192.168.255.254
172.16.0.1	172.31.255.254
10.0.0.1	10.255.255.254

4.5.3. Usage

In a HDLM 8 environment, all IP addresses should match except the last octet, which must be individual. If not, you will not get a working connection. This concerns also the *Network Link Groups* between interconnected HDLM 8 devices. Examples:

Table 4.2.: Addressing Examples

IP Address	Device
192.168.0.1	Laptop Stage
192.168.0.2	Laptop PA Operator
192.168.0.10	HDLM 8 PA left
192.168.0.11	HDLM 8 PA right

A. Appendix

A.1. Definition of Terms

For a better understanding of the conceptual design, some important terms are described below.

A.1.1. Project

All individual settings concerning *Input Busses* and *Outputs* will be stored in a *Project*[1] file. There is no restriction in quantity. Settings in the *Device Menu* are globally effective and are not part of a project file.

A.1.2. Loudspeaker

A *Loudspeaker* contains all relevant speaker data: cross-over frequencies, offset delays, impedances, power and equalization settings. It contains up to four single speaker paths with individual labels like HIGH, LOW, MID and SUB. After that, a Loudspeaker allocates multiple *Outputs* if required.
All *Loudspeakers* are compiled to the *Loudspeaker Library* hierarchically and are or may be protected using a code. The HDLM 8 comes with a factory-made Loudspeaker Library, including all Loudspeakers by SEEBURG acoustic line.

A.1.3. Loudspeaker Editor

Loudspeakers will be defined using a proprietary description language using the *Loudspeaker Editor* tool. The tool is only available by the web interface. If the Loudspeaker is protected by a code, the description will be hidden to the user.

A.1.4. Input Bus

An *Input Bus* is an internal input channel, working independently of the physical inputs. Any physical input may be mixed together to one Input Bus. There are eight Input Busses in the HDLM 8.

A.1.5. Output

An *Output* is an output channel, which is fixed to its dedicated physical analog output.

[1] frequently called *Preset* in the past

A.2. dBu, dBV, dBFS and dBGR

To avoid any confusion, the dB-units used will be explained below.

A.2.1. dBu vs. dBFS

The unit dBu[2] describes the logarithmic voltage ratio with a reference voltage of $\approx 0,775V$ and is known in common parlance as *the dB* in case of audio signal voltage[3]. Every audio device is subject to processing a maximum signal level before distortion. This value corresponds to $0dBFS$ (=**F**ull **S**cale).
The HDLM 8 can process a maximum signal level of $20dBu$ (Table A.1).

Table A.1.: dBu vs. dBFS in the HDLM 8

dBu	dBFS
20	0
4	-16
0	-20

Positive dBFS Values

Values above $0dBFS$ are not possible in analog terms. But the HDLM 8 has the ability to reach any level without distortion, internally. Levels above $0dBFS$ will be effectively limited by the output limiters.

dBm

The dBm refers to 1 milliwatt. Underlying an impedance of 600Ω, one can equate the dBm with the dBu. This unit is not used in the audio engineering, but can be displayed by the HDLM 8. In addition, the output drivers of the HDLM 8 are very low-impedance and would drive 600Ω loads without trouble.

A.2.2. dBV

The unit dBV refers to $1V$ and has its primary use in home theatre. The HDLM 8 has the possibility to display this unit also.

A.2.3. dBGR

The dBGR (=**G**ain **R**eduction) describes the magnitude of gain reduction of a compressor-limiter unit. While $0dBGR$ means no difference in level, $6dBGR$ corresponds to the half signal level.

[2] u=**u**nloaded, in contrary to dBm=reference *power* of 1 **m**illiwatt
[3] There is a reference value frequently mentioned, like $+4dBu$, describing a nominal level meaning 100% plus head room.

A.3. FAQ – Frequently Asked Questions

A.3.1. Why is there no Low Pass Filter (LPF)?

The user configurable EQs are only subject for correcting the *final system*. Using a low pass filter, one might misuse this as an cross-over filter. Thus, the entire conception of the HDLM 8 would be destroyed. Cross-over filters (including low pass) are only available in the *Loudspeaker Library*.

A.3.2. Why can't I set a particular Tweeter Louder?

The conception specifies closed loudspeaker systems, which provide factory-made, linear frequency response. This work is done by engineers with professional measuring equipment and long lasting experience. If one could re-adjust a single property of that, the whole character would be lost. In addition, this would shift the effective cross-over frequencies.

Never adjust the volume of a single speaker path (like a tweeter) at the amplifier! Always use equalization, which will affect the whole loudspeaker system (keeping important properties like the relative phase)!

A.4. Keyboard Operation

ENTER	Invoke a Menu or Apply a Function
EXIT	Exit a Menu (hold long to go to the start page)
MUTE	Mute or un-mute selected channel
EQ	Go to *EQ* page
↑ ↓ ← →	Move Selection
◉	Change Value
↑ ↓ ← → + ◉	Move Selection using rotary encoder
MUTE + ENTER	Mute all *Outputs*
EQ + ENTER	Lock or Unlock the Keyboard
ENTER + ◉	Text field: delete Character (delete or backspace)
ENTER + ◉	Number field: fine steps (e.g. $0,1dB$ steps)

A.5. Menu Structure

The following diagram shows the structure of the menus presented on the display of the HDLM 8.

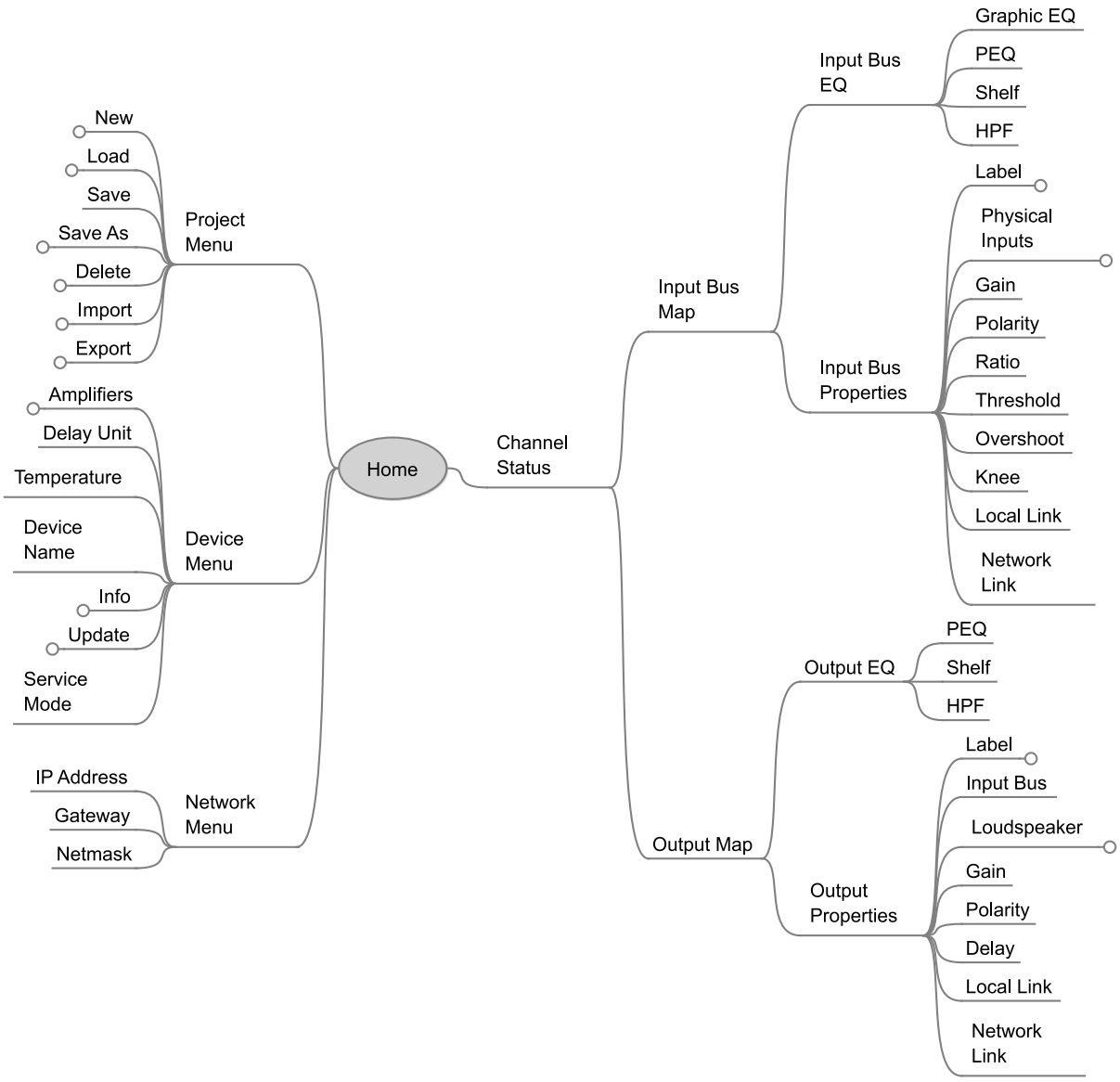


Figure A.1.: Structure

A.6. Product Specifications

Features	
Analog Inputs	4x Balanced
Analog Outputs	8x Balanced
Digital Inputs	2x Stereo AES/EBU (Analog C+D are switchable to AES/EBU)
Optional I/O	ADAT, AVB Audio-Video-Bridging
Network Connection	2x Switched 100 MBit Ethernet
Data Connection	1x USB 2.0
Power Connection	Neutrik PowerCon
Power Supply	110 to 230VAC / max. 30W
Size/Weight	483x270x44mm / 3.5kg
Signal Processor	2x FPGA
Operating System	Linux
Controls	Cursor Keys, Enter, Exit, Mute, EQ, Rotary Encoder
Display	Color TFT, Wide Viewing Angle
Remote Control	Web App, iOS App, Android App
Sample Rate	96kHz
Quantization	32bit IEEE Floating Point
Filter Topology/Count	480x High Precision Lattice-Ladder IIR
Signal Structure	8 Input Busses, 8 Output Channels
Input Bus Features	Input Assign (Matrix Mixer), Gain, Polarity, Compressor
Input Bus EQs	12 to 24dB HPF, 5x Parametric, High Shelf, Low Shelf, 31 Band Graphic EQ
Output Channel Features	Gain, Polarity, Delay, Loudspeaker Assignment
Output Channel EQs	12 to 24dB HPF, 4x Parametric, High Shelf, Low Shelf
Loudspeaker Features	1-4 Way, Gain, Polarity, Peak Limiter, Thermal Power Limiter, Offset Delay
Loudspeaker EQs	6 to 48dB HPF/LPF, Parametric EQs, 6 to 12dB High/Low Shelf, 1st and 2nd Order All-Pass Filters
Loudspeaker Presets	Structured Database using Loudspeaker Configuration Language
Channel Linking	8 Local Link Groups, 16 Network Link Groups
Wireless LAN Option	Built-in WLAN Access Point with External USB Antenna, WPA2-secured
Security Locks	Projects, Loudspeakers, Controls, User Interface
Signal Redundancy	Fallback to Analog Inputs on Digital Failure
Power Redundancy	Optional 2nd built-in Power Supply, Optional external 24V-Supply
Audio Converters Brand	Burr Brown
Cooling	Passive / No Fan
Origin	Made in Germany

Audio Specifications	
Analog Inputs	
Impedance	10$k\Omega$ nominal
Common Mode Impedance	100$k\Omega$ nominal
Maximum Amplitude	20dBu
Dynamic Range	119$dB(lin.)$ / 121$dB(A)typ.$
Common Mode Rejection Ratio	$>$ 100dB@50Hz
Analog Outputs	
Impedance	150Ω
Maximum Amplitude	20dBu
Dynamic Range	119$dB(lin.)$ / 121$dB(A)typ.$
Digital Inputs	
Impedance	110Ω
Type	Transformer Isolated Balanced AES/EBU
Acceptable Sample Rate	32 to 96kHz
Analog In to Analog Out	
Frequency Response	20Hz to 20kHz +0/$-$0.15dB
Signal-to-Noise Ratio	$-$115$dBFS(CCIR-RMS)$
Noisefloor	$-$98$dBu(A)$
THD+N	0.001%
Intermodulation Distortion	$<-104dB(SMPTE/DIN)$
Latency	0.76ms
Digital In to Analog Out	
Frequency Response	20Hz to 20kHz +0/$-$0.17dB
Signal-to-Noise Ratio	$-119dBFS(CCIR-RMS)$
Noisefloor	$-102dBu(A)$
THD+N	$<$ 0.0004%
Intermodulation Distortion	$<-110dB(SMPTE/DIN)$
Latency	0.92ms